The integration of smart card readers into personal computers

The Digital Security Initiative, a work group of the Smart Card Alliance, produced this article. With the increasing recognition that security must be tightened on enterprise networks, the use of smart card technology is expected to grow rapidly. IDC forecasts that hardware authentication devices used in network security will grow at 48% CAGR per year through 2005. An important part of the security infrastructure is the smart card reader. This document tells the story of the smart card reader's integration into the personal computer and provides a peak into future developments.

Background

Smart card readers have been connected to PCs for more than a decade. During this period, network computing has seen a dramatic maturation in the security architecture and the development of tools used to secure enterprise computing. This change has redefined the smart card reader, taking it from an external peripheral classification to an integral part of a secure network architecture.

The Early Days – Developers Dictate

In the beginning (1988), smart card readers were made by smart card manufacturers for developers, who in turn developed systems, typically from scratch, with those assets most readily available. In that formative period, not unlike other rapidly developing industries, interoperability and cost issues were secondary to speed to market.

In fact, the technology was so new that only smart card manufacturers had the expertise necessary to produce readers. Card manufacturers typically sold a development kit, which included a few cards, documentation, a smart card reader and a software library linked into their code. With little competition and limited distribution, these kits were expensive with the readers priced from $100 to $200 and development kits from $1000 to $2000.

Once an application was developed with a manufacturers development kit, switching to another manufacturer was not a palatable option. The industry lacked a standard API in DOS or Windows, and little impetus existed to drive standardization among the staunchly competitive card manufacturers.

Developers faced another significant challenge in physically connecting the reader to the PC. At the time there was a mouse on one serial port and frequently a modem on the other. The industry developed parallel port readers, but these competed for connection with printers. The lack of applicable standards was literally choking-off the maturation of the reader technology.

The late 90's – PC Industry Recognizes Smart Cards

By the mid-nineties conditions began improving for the smart card industry. Smart cards were making their mark in the U.S. with several visible financial test programs. The U.S. military was deploying military ID cards and 2nd generation wireless phones with smart cards were being introduced.

It was during this time that Microsoft recognized the importance of smart card technology and helped organize the Personal Computer / Smart Card Workgroup (PC/SC

workgroup) which developed the first standardized approach to using smart card technology in conjunction with a PC. The PC/SC Workgroup was instrumental in the development of software, which could be added to the Windows 95/98 operating system to provide an interoperable interface for application developers. The Linux camp also launched an effort called MUSCLE (Movement for the Use of Smart Card in Linux Environments), which supported Linux, Solaris, and Mac OS X operating systems. Both groups added momentum to the growth of the industry. They also provided an opening for non-smart card manufacturers to provide readers to the industry. As of January 2002, the PC/SC workgroup had identified more than 190 available smart card readers (PC/SC workgroup site).

The PC 98 System Design Guide, led by Intel and Microsoft, guided the development of ever evolving PC, first included a smart card reader as a recommended element. PC 99 and PC 2001 have continued to recommend the smart card reader in the architecture.

Microsoft's White Paper on Smart Cards enhanced the technology's profile in an unprecedented fashion. Much more than a diluted press release or passing mention by the industry giant, the document went to great lengths to legitimize the case for smart cards

Perhaps the most bullish statement from Microsoft on Smart card technology came in a section entitled 'Why Smart Cards?' Said Microsoft, "The smart card will become an integral part of the Windows platform because smart cards provide new and desirable features as revolutionary to the computer industry as the introduction of the mouse or CD." The question of "why?" had been addressed; the next question was "how?"

Still not ready for Prime Time

In spite of these encouraging developments, there were still obstacles to installing smart card readers on PCs. Windows 98 offered support for USB but Windows NT did not. Thus on desktops running Windows NT, smart card readers were forced to compete for a serial port with other peripherals. Smart card reader installation on computers using Windows 95/98 required the installation of the PC/SC software and smart card drivers. This lack of plug-and-play support and early problems including the negative impact of driver installation created a noticeable delay in adoption and deployment.

The new Millennium – Ready for Smart Cards

Beginning with Windows 2000 and continuing with Windows XP, support for PC/SC smart card readers and other security software components have been included in the operating system. Combining this with the support for USB ports, the era of smart card reader plug and play had arrived. It only took ten years!

Recent large-scale implementation of government projects, initiatives by major financial institutions, and the renewed interest in physical and logical security has seen the installation of hundreds of thousands of smart card readers. With prices coming down to below $20 a reader, the increased emphasis on security and the hundreds of millions of installed PCs, it is clear the attached reader market will enjoy several years of good growth.

Will the separate Smart Card Reader disappear?

In what is probably the most encouraging statement of the PC smart card reader's acceptance is its disappearance as a separate entity. Two exciting developments are at the root of this.

The reader moves into the semiconductor chips

Companies that make the PC system logic chips have licensed smart card reader technology and incorporated it in their products for laptops and desktops. This means PC manufacturers can include a low cost smart card reader by simply incorporating the smart card connector into their case.

A second solution provided by silicon suppliers is to incorporate the reader into the USB keyboard chip set. In the past, installing a smart card reader meant losing an I/O port. With the introduction of USB keyboard/ smart card readers, the system actually gains USB ports since the keyboards typically have additional USB expansion ports.

The reader moves into the smart card

Recently the smart card manufacturers and their silicon supplier partners succeeded in incorporating the USB interface logic directly in the smart chip silicon. The design required that the smart card serial I/O subsection of the smart card accommodate the standard serial communication protocols and the USB protocol. By making this enhancement, the smart card can be connected almost directly to the USB port. As a result, the USB reader has been reduced to simply a connector. There are two implementations of this USB only reader, one is a full sized card and the second is shown in the image above. Inside the plastic case is a 'punch-out' version of a smart card (referred to as a SIM in the industry) that interfaces directly to the USB port of a PC. It should be noted that this USB only reader would only be used in projects that do not need to support legacy smart cards.

The group responsible for the USB specification has recently defined a new protocol for USB Smart Card Reader (CCID). This specification allows an application to communicate directly with a smart card without going through a driver provided by the manufacturer.

Conclusion

Much progress has been made over the last decade. Many in the industry lament this prolonged period of development, but many of the developments were dependent upon parallel progress in the PC industry. With the increasing recognition that security must be tightened, and the growing list of Enterprises that are investing in smart card technology, it is imperative that information technology management develop plans to implement smart card technology.

Author

The Digital Security Initiative work group, part of the Smart Card Alliance, wrote the article. To learn more about smart cards and the Digital Security Initiative, visit the DSI section of the Smart Card Alliance web site (www.smartcardalliance.org).